

Four Dimensional Equalizer and Far-End Cross Talk Canceler in Gigabit Ethernet Signals

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Abstract of the Disclosure

Spec A2 A multidimensional equalizer and cross talk canceler for a communication network that simultaneously removes far end cross talk (FEXT) and intersymbol interference (ISI) from a received signal. A multidimensional-pair channel is treated as a single multidimensional channel and a receiver in the communication network equalizes received signals through the use of the multidimensional equalizer. A decision feedback equalizer determines a multidimensional steepest descent gradient to adjust matrix coefficients that are proportional to estimates of

$$\frac{\partial e_n}{\partial Q_k^{i,j}}, \text{ wherein } Q_k^{i,j} \leftarrow \left(Q_k^{i,j} - \mu \cdot \left(\frac{\partial e_n}{\partial Q_k^{i,j}} \right) \right)$$

and

$$\frac{\partial e_n}{\partial Q_k^{i,j}} = 2 \cdot (Z_n^i - X_{n-p}^i) \cdot Y_{n-k}^j.$$

The equalizer includes:

- a vector data unit delay operator that passes the received data vector Y_n through a series of unit delay operators to generate successive tap input data Y_n, Y_{n-1}, Y_{n-2} ;
- a first matrix multiplication operator that receives a $1 \times N$ matrix Y_{n-k} from the unit delay operator and multiplies it with the $N \times 1$ matrix of scaled vector error data $(Z_n - X_n)$ to generate a $N \times N$ adjustment matrix;
- a matrix summation operator that adds the adjustment matrix to a Q_{n-k} tap matrix and outputs a corrected tap matrix Q_{n-k+1} ;
- matrix tap unit delay operator that receives the corrected tap matrix Q_{n-k+1} , and introduces a one cycle delay to generate a Q_{n-k} tap matrix; and
- a second matrix multiplication operator that multiplies the Q_{n-k} tap matrix from the matrix tap unit delay operator by the Y_{n-k+1} vector from the vector data unit delay operator.